Space Weather Technical Forecast

Issued on Wednesday 23 October 2024 at 01:09 Local

This technical forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Increasing chance of Radio Blackouts.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Activity observed at GOES16 and 18 was Low - with a generally smooth and gradually declining X-ray trace at C-class levels, and only occasional minor C-class flares peaking at C5.1 at 22/1211 UTC.

There are seven numbered sunspot regions on the visible disc, and a new region rotating onto the southeast limb. None of the regions are especially large, magnetically complex or showing any significant changes. However, AR3859 has historically had a beta-gamma configuration and this classification is maintained, now that the region is becoming harder to view as it approached the west limb.

A filament eruption was observed in centre disk around 22/0500UTC but no CME has yet been identified. Another filament eruption occurred around 22/1715 UTC in the northwest quadrant. This filament was small but an associated CME was generated. Analysis is currently being undertaken, but initial expectations are that the CME will not be Earth directed.

Solar Wind / Geomagnetic Activity: Solar winds, as measured by ACE at L1, were indicative of a slow regime. The solar wind speed ranged from generally 290 km/s to 330 km/s. The solar wind density was predominantly at average levels until late in the day, then increasing to become slightly above average. The IMF was at Background levels at or below 8nT, but with a rising trend after 22/0330UTC, while the north-south component ranged between +5 and -7nT. The phi angle was negative (towards the Sun) until 22/0330UTC before becoming positive (Away from the Sun) thereafter. The net result of the above solar wind measures was Quiet to Unsettled (K1-3).

Energetic Particles / Solar Radiation: High energy proton flux observed by GOES18 was at Background levels. High energy electron flux (greater than 2MeV) observed by GOES16 was mainly at Normal Background levels, but with a Moderate peak of 290pfu at 22/1440 UTC. The associated 24-hour fluence was well below the Active threshold. The 23/0000UTC observation was 3.22e6 integrated pfu with a gradual downward trend.

Four-Day Space Weather Forecast Summary

Solar Activity: Activity is Likely to be Low, with a Chance of Moderate activity from isolated M-class flares initially, until new or returning regions rotate onto the visible disc. Several notable

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active regions may arrive from behind the eastern limb, potentially increasing the solar activity later in the period.

Solar Wind / Geomagnetic Activity: Currently there are no Earth-directed CMEs in the forecast, although modelling of the CME from the small filament eruption in the northwest on the 22nd Oct is awaited. Initial expectations are that the bulk of the CME will not be Earth directed. A weak high speed stream (HSS) may become established today from CH82/+, although this is now looking increasingly unlikely. More likely is the arrival of a HSS from CH84, which is almost centre disc. late day 2 (24th) or through day 3 (25th). Overall background solar winds are expected to predominate, with mainly Quiet to Unsettled (Kp 0-3) geomagnetic activity, and just a slight chance of Minor/G1 geomagnetic storm levels (Kp 4-5) being reached at times later in the forecast period.

Energetic Particles / Solar Radiation: High energy proton flux at GOES18 is Expected to remain at Background levels.

High energy electron flux at GOES16 is forecast to remain at mainly Background to Moderate levels, with the associated 24-hour fluence Expected to remain below Active (1e8 total pfu) throughout.

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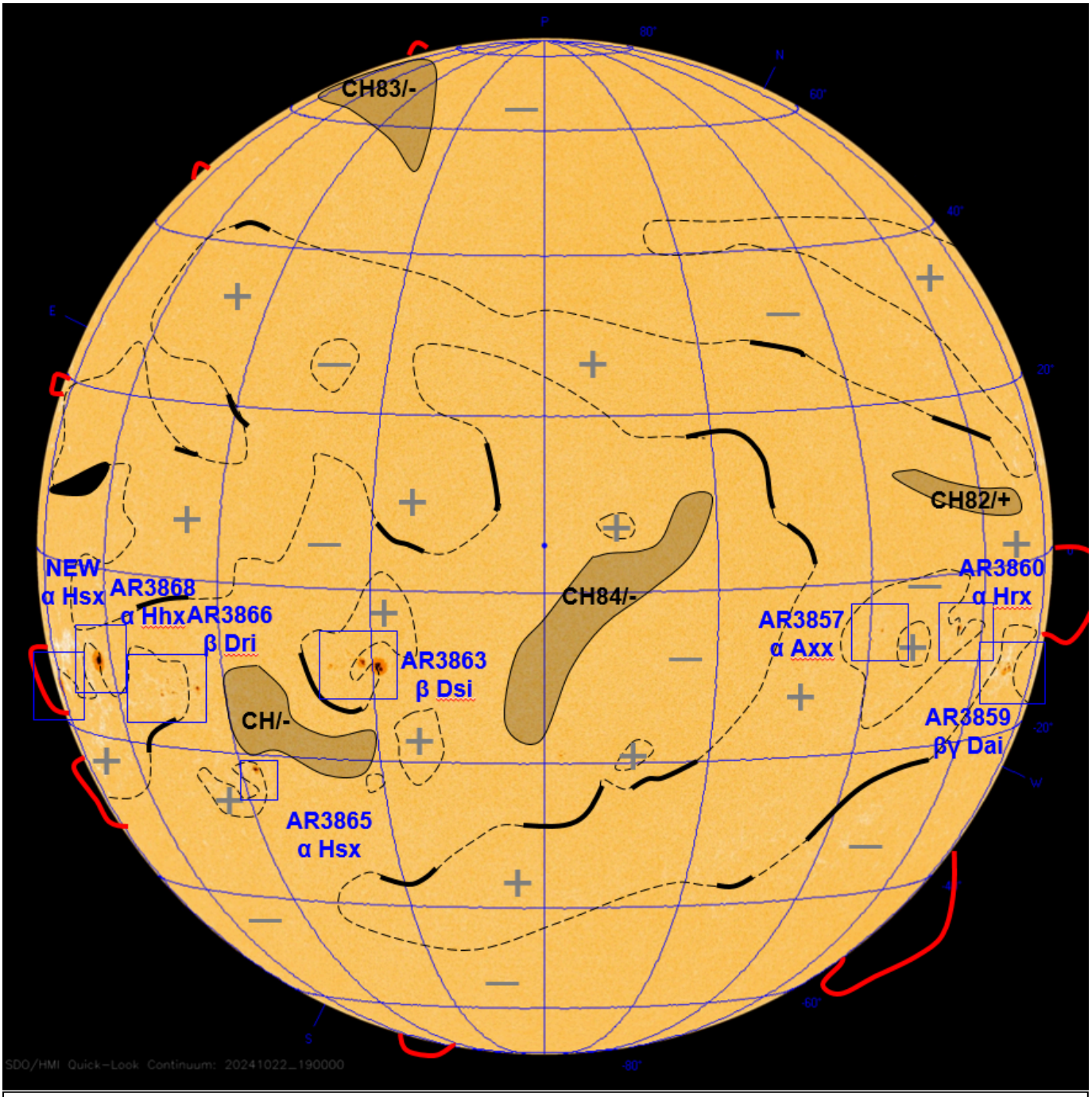
Figure 1: Solar synoptic map valid 22/1900 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms

No Earth-directed CMEs currently feature in the forecast, although there is potential for a glancing blow from the filament eruption CME in the northwest quadrant in the 22nd, perhaps day 3 (25th) or during day 4 (26th). However, most of the CME material is likely to miss Earth.

Solar winds are currently at Background levels. There is now a decreasing chance of a HSS from CH82/+ reaching Earth. This is a recurrent, but smaller coronal hole compared to the previous rotation, but due to its equatorial location it was expected that a HSS would connect to Earth. A weak CIR may have occurred early on the 22nd, but no HSS followed, only an eventual slight increase in the solar wind's density. MOSWOC Enlil model output does show a solar wind enhancement from late today. This may be due to a very late HSS arrival from CH82, or more likely from a HSS associated with CH84. This coronal hole is a recurrent coronal hole,, currently just west of centre disc, and is marginally more substantial compared to the previous rotation when slightly elevated winds occurred but no significant geomagnetic activity. Enlil's expectations of the HSS is considered to be at least 24 hours too early.

Geomagnetic activity is forecast to be predominantly Quiet to Unsettled (Kp 0-3) but with a slight chance of G1/Minor geomagnetic storm intervals occurring later in the period, due either to a glancing CME arrival or a HSS connection.

Geomagnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	10	1	20	10
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

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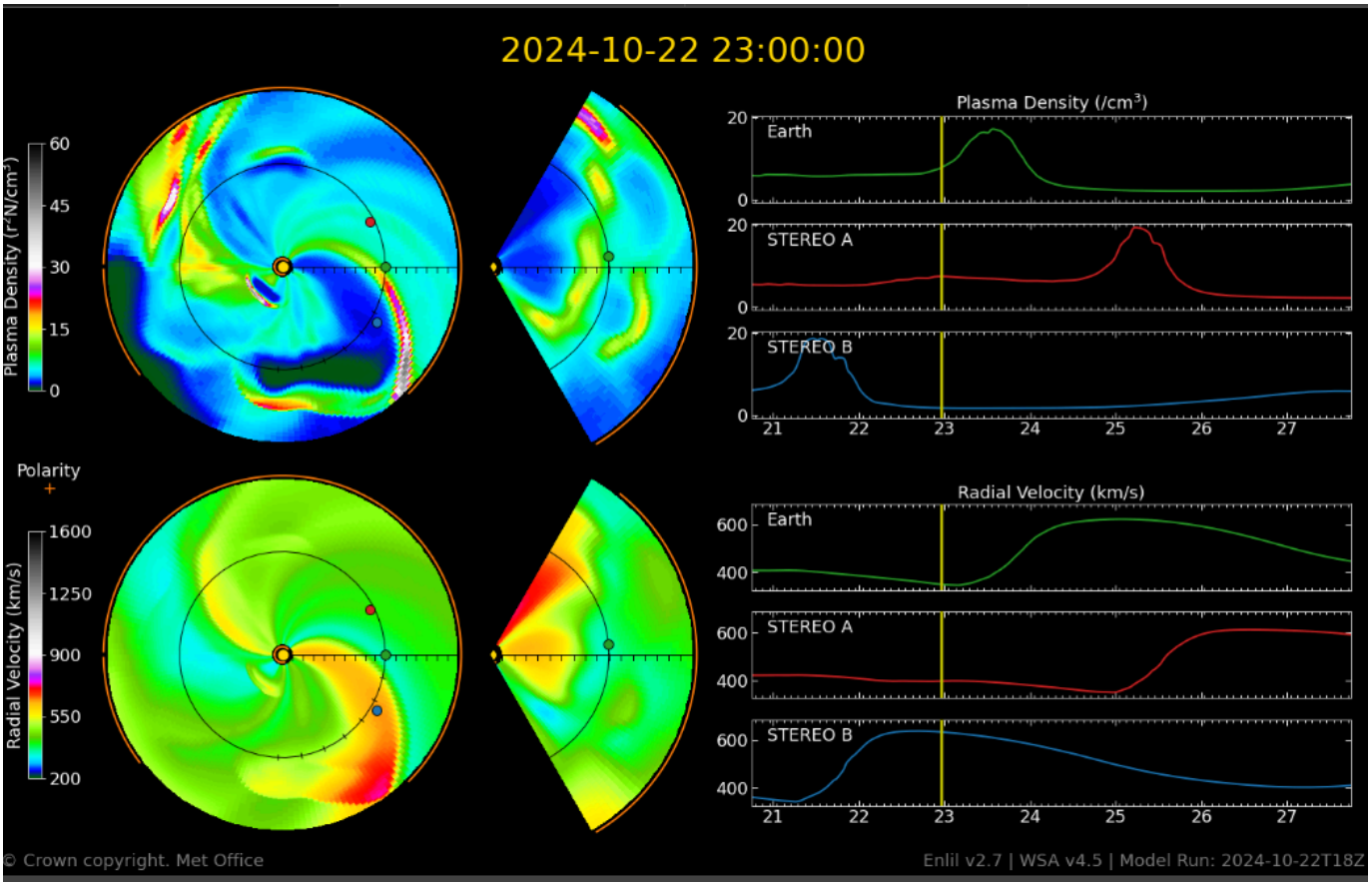
Figure 2: Latest MOSWOC Enlil



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Radio Blackouts - X-Ray Flares

There are seven numbered sunspot regions on the visible disc. Most regions appear stable or have shown slight decay, with only AR3866 apparently showing a slight increase in spot number, although this could be a result of the region transiting into a clearer viewing angle. All regions are small or only modestly sized, and the majority of regions are magnetically simple. AR3859 is the exception, with a historically moderate magnetic structure, which has been retained in the current classification as the region becomes harder to analyse as it approaches the west limb.

Activity is expected to increase in the coming days, as recurrence, recent CME activity, and far-side sounding data all suggest the return of several active regions that were present on the disc earlier in October. Bright looping is evident near the eastern limb in SDO AIA171 imagery, with recurrence suggesting the return of Ex-AR3842, previous source of several strong flares (including SC25's peak X9.0 flare on 03 October) through the forecast period. As such, activity should increase to become generally Moderate, with M-class flares Likely, and an increased, but still Slight Chance of isolated X-class flares, dependent on the size and configuration of the regions once they become apparent in EUV imagery.

X-Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 (M Class)	No	30	40	60	60
Very Active	R3-R5 (X Class)	No	5	10	10	10

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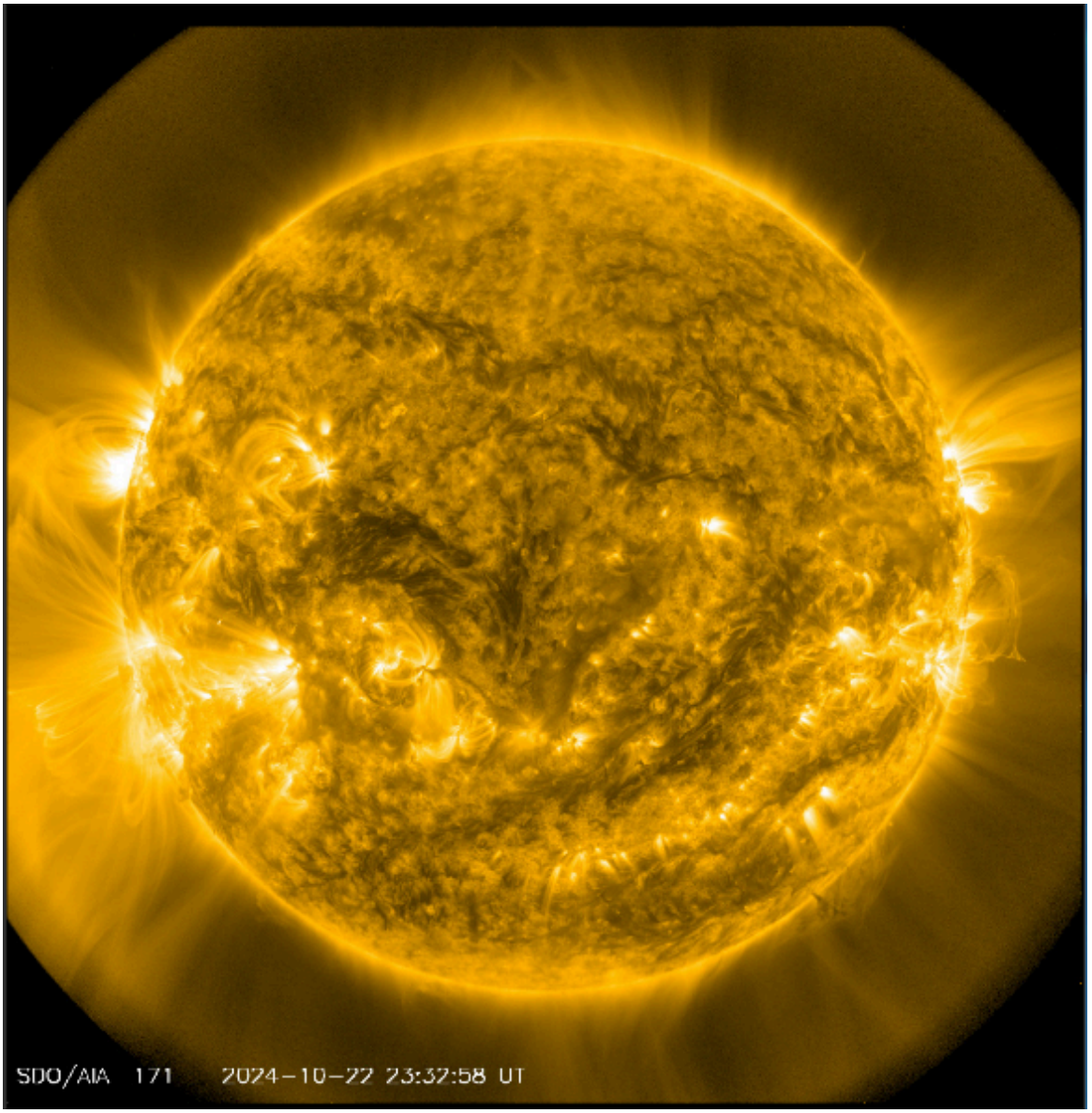
Figure 3: Latest SDO/AIA 171 image.



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Solar Radiation Storms (High Energy Protons)

High energy proton flux at GOES18 is expected to remain at Background levels. There is only a very Slight Chance of a significant enhancement, with limited flare activity observed from the regions currently on the visible disc, and any more potent east limb arrivals a long way from more threatening solar longitudes.

Radiation Storms Probability (Exceedance)	Level ($cm^{-2}sr^{-1}s^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	5	5	5
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and/or 50 MeV ≥ 10pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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High Energy Electrons (≥ 2MeV)

High energy electron flux (greater than 2MeV) as observed by GOES16 has mainly been at Normal Background levels, with only brief incursions above the Moderate threshold at diurnal peak. The expected onset of fast winds from central disc CH82/+ has not occurred, and therefore little change is expected immediately in the high energy flux. During day 4 (26th) the electron flux may start to increase under the influence of a HSS from CH84, reaching mainly moderate levels.

The associated 24-hour fluence is currently expected to remain below Active throughout the period, with MOSWOC REFM thought to be providing good guidance.

GEO Electron Environment Probability (Exceedance)	Level ($cm^{-2}sr^{-1}$ day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ 1×10^{8}**	No	1	1	5	10
Very Active	**≥ 2 MeV ≥ 1×10^{9}**	No	1	1	1	1

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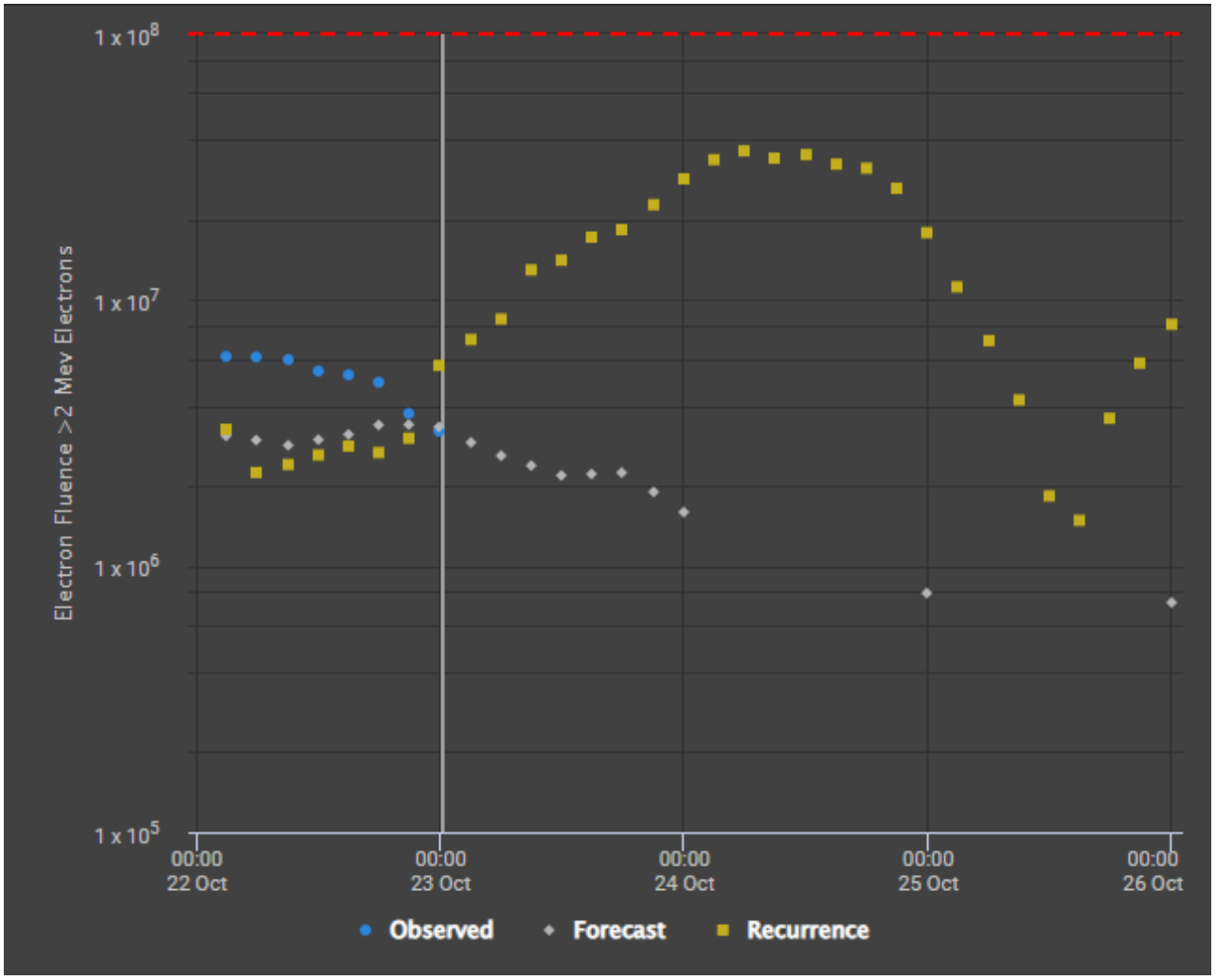
Figure 4: Latest MOSWOC REFM model.



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